

ABSTRACT

Methods of forming copper interconnects free from via-to-via leakage currents and having low resistances are disclosed. In a first aspect, a barrier layer is deposited on the first metal layer prior to copper oxide sputter-etching to prevent copper atoms from reaching the interlayer dielectric and forming via-to-via leakage current paths therein. In a second aspect, a capping dielectric barrier layer is deposited over the first metal layer prior to sputter etching. During sputter-etching, the capping dielectric barrier layer redistributes on the sidewalls of the interlayer dielectric, preventing sputter-etched copper atoms from reaching the interlayer dielectric and forming via-to-via leakage paths therein. In a third aspect, both a capping dielectric barrier layer and a barrier layer are deposited over the first metal layer prior to sputter-etching to prevent copper atoms produced during sputter-etching from reaching the interlayer dielectric and forming via-to-via leakage paths therein.